What is claimed is:

1. Ophthalmic device comprising a hologram-based sensor for monitoring an analyte level in ocular fluid.

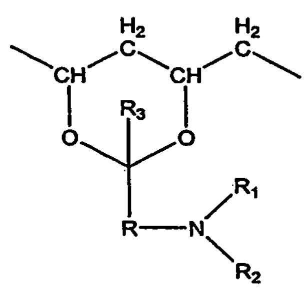
2. Ophthalmic device according to claim 1, which is selected from the group consisting of a contact lens, a corneal onlay, and an implantable ophthalmic device, in particular an implantable subconjunctival device.

3. Ophthalmic device according to claim 1 or 2, wherein the analyte is glucose.

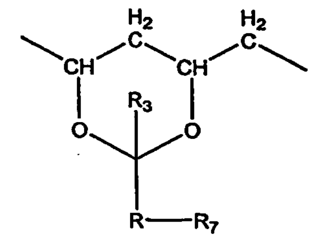
4. Ophthalmic device according to any one of claims 1 to 3, comprising a reflection hologram-based sensor.

5. Ophthalmic device according to claim 4, comprising a crosslinked and/or polymerized material and incorporated therein a molecular sensing moiety, which can interact or react with the analyte of interest to provide a signal which is indicative of a change in one or more optical properties of the reflection hologram.

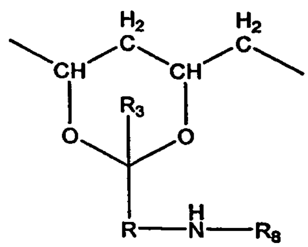
6. Ophthalmic device according to claim 5, wherein the crosslinked and/or polymerized material is a polymer which is obtainable by crosslinking and/or polymerizing a prepolymer selected from the group consisting of
(i) a polyhydroxy compound which has a molecular weight of at least about 2000 and comprises from about 0.5 to about 80%, based on the number of hydroxyl groups in the poly(vinyl alcohol), of units of the formula I, I and II, I and III, or I and II and III




I



II

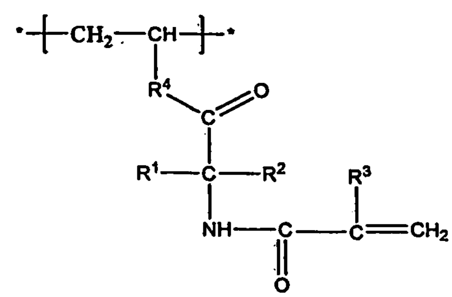


III

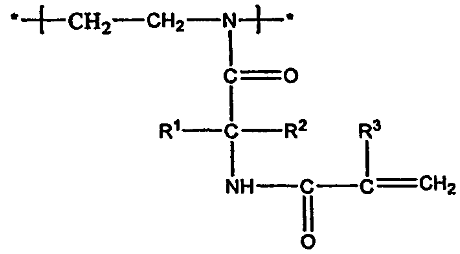
wherein R is alkylene having up to 12 carbon atoms; $R_1$ is hydrogen or lower alkyl having up to seven carbon atoms; $R_2$ is an olefinically unsaturated, electron-withdrawing, crosslinkable radical having up to 25 carbon atoms; $R_3$ is hydrogen, a $C_1$ -$C_6$ alkyl group or a cycloalkyl group; $R_7$ is a primary, secondary or tertiary amino group or a quaternary amino group of the formula $N^+(R')_3X^-$, in which each R', independently of the others, is hydrogen or a $C_1$ -$C_4$ alkyl radical and X is a counterion selected from the group consisting of $HSO_4^-$, $F^-$, $Cl^-$, $Br^-$, $I^-$, $CH_3COO^-$, $OH^-$, $BF^-$, and $H_2PO_4^-$; and $R_8$ is the radical of a monobasic, dibasic or tribasic, saturated or unsaturated, aliphatic or aromatic organic acid or sulfonic acid;

(ii) a vinyl group-terminated polyurethane which is obtained by reacting an isocyanate-capped polyurethane with an ethylenically unsaturated amine (primary or secondary amine) or an ethylenically unsaturated monohydroxy compound, wherein the isocyanate-capped polyurethane is a copolymerization product of at least one polyalkylene glycol, a compound containing at least 2 hydroxyl groups, and at least one compound with two or more isocyanate groups; or

(iii) a derivative of a polyvinyl alcohol, polyethyleneimine or polyvinylamine, wherein the derivative contains from about 0.5 to about 80%, based on the number of hydroxyl groups in the polyvinyl alcohol or the number of imine or amine groups in the polyethyleneimine or polyvinylamine, respectively, of units of the formula VI and VII



(VI)

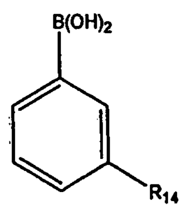


(VII)

wherein $R^1$ and $R^2$ are, independently of one another, hydrogen, a $C_1$-$C_8$ alkyl group, an aryl group, or a cyclohexyl group; $R^3$ is hydrogen or a $C_1$-$C_8$ alkyl group; and $R^4$ is an -O- or -NH- bridge, wherein the polyvinyl alcohol, polyethyleneimine or polyvinylamine has a number average molecular weight between about 2000 and 1,000,000.

7. Ophthalmic device according to claim 5, wherein the crosslinked and/or polymerized material is a polymer which is obtainable by crosslinking and/or polymerizing a prepolymer selected from the group consisting of a crosslinkable polyacrylamide; a crosslinkable statistical copolymer of a vinyl lactam, methyl methacrylate and a comonomer; a crosslinkable copolymer of a vinyl lactam, vinyl acetate and vinyl alcohol; a polyalkylene glycol polyether-polyester copolymer with crosslinkable side chains; a branched polyalkylene glycol-urethane prepolymer; a polyalkylene glycol-tetra(meth)acrylate prepolymer; and a crosslinkable polyallylamine gluconolactone prepolymer.

8. Ophthalmic device according to any one of claims 5 to 7, wherein the molecular sensing moiety is a phenyl boronic acid having formula



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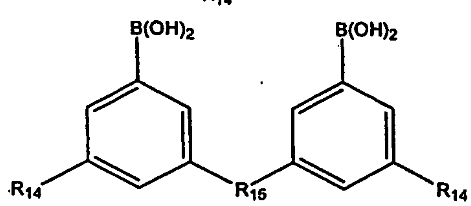

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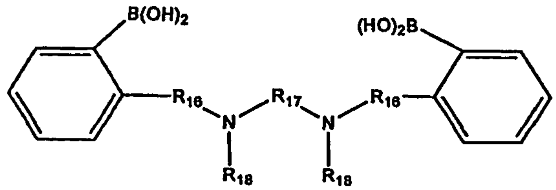


(6)

wherein $R_{14}$ and $R_{18}$, independently of each other, are olefinically unsaturated, crosslinkable radicals; $R_{15}$ and $R_{16}$, independently of each other, are alkylene having up to 12 carbon atoms; and $R_{17}$ is an arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, arylenealkylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms.

9. Ophthalmic device according to any one of claims 5 to 7, wherein the crosslinked and/or polymerized material comprising a molecular sensing moiety is obtainable by crosslinking and/or polymerizing the crosslinkable and/or polymerizable fluid material in an aqueous solution, wherein the aqueous solution includes a low molecular weight additive which exhibit a limited compatibility with a polymer matrix resulted from the crosslinkable and/or polymerizable fluid material, but good compatibility with water, wherein the low molecular weight additive is present in an amount sufficient to increase refractive index differences (delta n) between high and low irradiated areas resulted from the pattern of interference fringes.

10. Ophthalmic device according to any one of claims 5 to 7, wherein the crosslinked and/or polymerized material comprising a molecular sensing moiety is obtainable by crosslinking and/or polymerizing the crosslinkable and/or polymerizable fluid material comprising at least one prepolymer and optionally a vinylic monomer, wherein at least one of the prepolymer and the vinylic monomer contains aromatic groups in an amount sufficient to increase refractive index differences (delta n) between areas of different polymer densities which are caused by different irradiations resulted from the pattern of interference fringes.

11. A method for making a biocompatible sensor containing a reflection hologram according to claim 4, comprising the steps of:
introducing a crosslinkable and/or polymerizable fluid material into a cavity formed by a mold, wherein the crosslinkable and/or polymerizable fluid material comprise at least a molecular sensing moiety which can interact or react with an analyte of interest to provide an optical signal which is indicative of a change in one or more optical properties of the

reflection hologram, wherein the mold has a first mold half defining a first molding surface and a second mold half defining a second molding surface, wherein said first mold half and said second mold half are configured to receive each other such that the cavity is formed between said first molding surface and said second molding surface; and
producing and recording a pattern of interference fringes while polymerizing/crosslinking said crosslinkable and/or polymerizable fluid material in the cavity to form the biocompatible sensor, thereby said pattern is recorded in said biocompatible sensor to form the reflection hologram.

12. The method of claim 11, wherein the step of producing and recording occurs by irradiating said crosslinkable and/or polymerizable fluid material with at least two beams of coherent light, wherein one of the two beams is directed to the crosslinkable and/or polymerizable fluid material through the first molding surface whereas the other beam is directed to the crosslinkable and/or polymerizable fluid material through at least a portion of the second molding surface, wherein the two beams of coherent light form said pattern while polymerizing/crosslinking said crosslinkable and/or polymerizable fluid material to form the biocompatible sensor, thereby said pattern is recorded in said biocompatible sensor to form the reflection hologram.

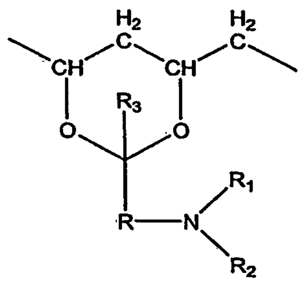
13. The method of claim 11 or 12, further comprising the step of partially crosslinking and/or polymerizing the crosslinkable and/or polymerizable fluid material by actinic irradiation, before the step of producing and recording.

14. The method of claim 13, wherein the step of partially crosslinking and/or polymerizing is performed by exposing the crosslinkable and/or polymerizable fluid material to a UV light with an energy level which is sufficient high to initiate crosslinking and/or polymerizing but low enough not to completely crosslink and/or polymerize the crosslinkable and/or polymerizable fluid material.

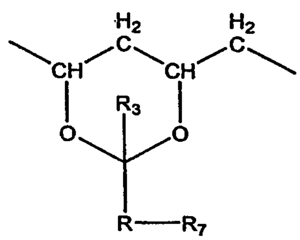
15. The method of claim 13, wherein the step of partially crosslinking and/or polymerizing is performed by exposing the crosslinkable and/or polymerizable fluid material to a UV light for a period of time short enough not to completely crosslink and/or polymerize the crosslinkable and/or polymerizable fluid material.

16. The method of any one of claims 11 to 15, wherein the crosslinkable and/or polymerizable fluid material comprises a water-soluble prepolymer.

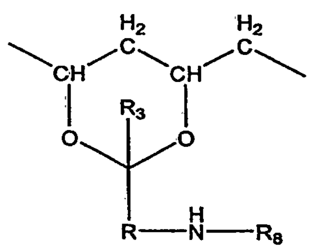
17. The method of claim 16, wherein the water-soluble prepolymer is a polyhydroxyl compound which has a molecular weight of at least about 2000 and comprises from about 0.5 to about 80%, based on the number of hydroxyl groups in the poly(vinyl alcohol), of units of the formula I, I and II, I and III, or I and II and III



I



II



III

wherein R is alkylene having up to 12 carbon atoms; $R_1$ is hydrogen or lower alkyl having up to seven carbon atoms; $R_2$ is an olefinically unsaturated, electron-withdrawing, crosslinkable radical having up to 25 carbon atoms; $R_3$ is hydrogen, a $C_1$ -$C_6$ alkyl group or a cycloalkyl group; $R_7$ is a primary, secondary or tertiary amino group or a quaternary amino group of the formula $N^+(R')_3X^-$, in which each R', independently of the others, is hydrogen or a $C_1$ -$C_4$ alkyl radical and X is a counterion selected from the group consisting of $HSO_4^-$, $F^-$, $Cl^-$, $Br^-$, $I^-$, $CH_3COO^-$, $OH^-$, $BF^-$, and $H_2PO_4^-$; and $R_8$ is the radical of a monobasic, dibasic or tribasic, saturated or unsaturated, aliphatic or aromatic organic acid or sulfonic acid.

18. The method of claim 17, wherein $R_2$ is an olefinically unsaturated acyl radical of the formula $R_4$ -CO-, in which $R_4$ is an olefinically unsaturated, crosslinkable radical having 2 to 24 carbon atoms.

19. The method of claim 17 or 18, wherein $R_2$ is a radical of formula IV or V

$$\text{-CO-NH-}(R_5\text{-NH-CO-O})_q\text{-}R_6\text{-O-CO-}R_4 \qquad \text{(IV)}$$

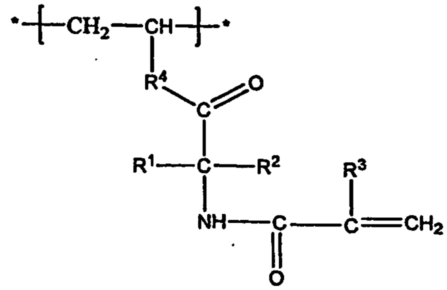
$$\text{-[CO-NH-}(R_5\text{-NH-CO-O})_q\text{-}R_6\text{-O]}_p\text{-CO-}R_4 \qquad \text{(V)}$$

wherein p and q, independently of one another, are zero or one; $R_5$ and $R_6$, independently of one another, are lower alkylene having 2 to 8 carbon atoms, arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, arylenealkylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms; and $R_4$ is an olefinically unsaturated, crosslinkable radical having 2 to 24 carbon atoms.

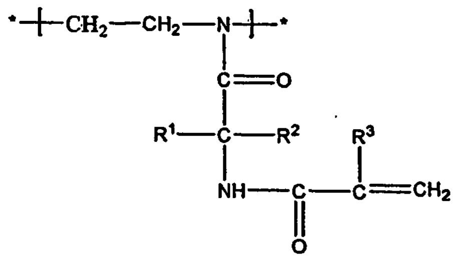
20. The method of any one of claims 11 to 16, wherein the water-soluble prepolymer is a polyurea prepolymer obtained by reacting an acryloylchloride or an isocyanate group-containing acrylate or methacrylate with a polymerization product of $NH_2$-terminated polyalkylene glycols and di- or polyisocyanates optionally in the presence of a triamine.

21. The method of any one of claims 11 to 16, wherein the water-soluble prepolymer is a vinyl group-terminated polyurethane which is obtained by reacting an isocyanate-capped polyurethane with an ethylenically unsaturated amine (primary or secondary amine) or an ethylenically unsaturated monohydroxy compound, wherein the isocyanate-capped polyurethane is a copolymerization product of at least one polyalkylene glycol, a compound containing at least 2 hydroxyl groups, and at least one compound with two or more isocyanate groups.

22. The method of any one of claims 11 to 16, wherein the water-soluble prepolymer is a derivative of a polyvinyl alcohol, polyethyleneimine or polyvinylamine, wherein the derivative contains from about 0.5 to about 80%, based on the number of hydroxyl groups in the polyvinyl alcohol or the number of imine or amine groups in the polyethyleneimine or polyvinylamine, respectively, of units of the formula VI and VII



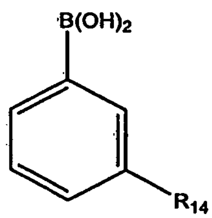
(VI)



(VII)

wherein $R^1$ and $R^2$ are, independently of one another, hydrogen, a $C_1$-$C_8$ alkyl group, an aryl group, or a cyclohexyl group; $R^3$ is hydrogen or a $C_1$-$C_8$ alkyl group; and $R^4$ is an -O- or -NH- bridge, wherein the polyvinyl alcohol, polyethyleneimine or polyvinylamine has a number average molecular weight between about 2000 and 1,000,000.

23. The method of any one of claims 11 to 22, wherein the molecular sensing moiety is a phenyl boronic acid having formula (4), (5), or (6)



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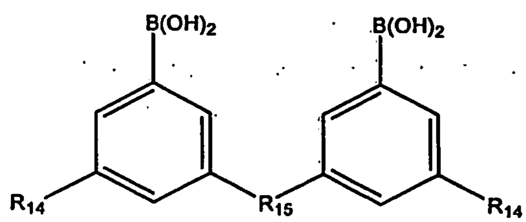

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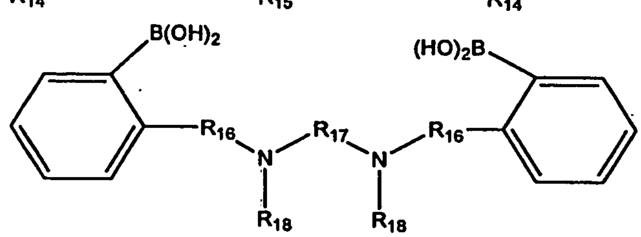


(6)

wherein $R_{14}$ and $R_{18}$, independently of each other, are olefinically unsaturated, crosslinkable radicals; $R_{15}$ and $R_{16}$, independently of each other, are alkylene having up to 12 carbon atoms; and $R_{17}$ is an arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, arylenealkylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms.

24. The method of any one of claims 11 to 22, wherein the crosslinkable and/or polymerizable fluid material is an aqueous solution, wherein the aqueous solution includes a low molecular weight additive which exhibit a limited compatibility with a polymer matrix resulted from the crosslinkable and/or polymerizable fluid material, but good compatibility with water, wherein the low molecular weight additive is present in an amount sufficient to increase refractive index differences (delta n) between high and low irradiated areas resulted from the pattern of interference fringes.

25. The method of claim 24, wherein the low molecular weight additive is NaCl.

26. The method of any one of claims 11 to 22, wherein the crosslinkable and/or polymerizable fluid material comprises at least one prepolymer and optionally a vinylic monomer, wherein at least one of the prepolymer and the vinylic monomer contains aromatic groups in an amount sufficient to increase refractive index differences (delta n) between areas of different polymer densities which are caused by different irradiations resulted from the pattern of interference fringes.

27. A biocompatible sensor produced according to the method of any one of claims 11 to 26.

28. The biocompatible sensor of claim 27, wherein the biocompatible sensor is an ophthalmic device, especially an implantable ophthalmic device, and in particular an implantable subconjunctival device.

29. The method of any one of claims 11 or 13 to 26, wherein the second mold half has, on or behind the second molding surface, a mirror to reflect light coming from the first molding surface, wherein the step of producing and recording occurs by directing an incident beam of coherent light to said crosslinkable and/or polymerizable fluid material through the first

molding surface, wherein the incident beam and a beam reflected by the mirror form said pattern while polymerizing/crosslinking said crosslinkable and/or polymerizable fluid material to form the biocompatible sensor, thereby said pattern is recorded in said biocompatible sensor to form the reflection hologram.

30. A biocompatible sensor produced according to the method of claim 29.

31. The biocompatible sensor of claim 30, wherein the biocompatible sensor is an ophthalmic device, especially an implantable ophthalmic device, and in particular an implantable subconjunctival device.

32. A method of claim for making a biocompatible sensor containing a reflection hologram, comprising:
providing an article having a first surface and an opposite second surface; spraying at least one layer of a crosslinkable and/or polymerizable fluid material onto the first surface of the article, using a spraying process selected from the group consisting of an air-assisted atomization and dispensing process, an ultrasonic-assisted atomization and dispensing process, a piezoelectric assisted atomization and dispensing process, an electro-mechanical jet printing process, a piezo-electric jet printing process, a piezo-electric with hydrostatic pressure jet printing process, and a thermal jet printing process, wherein the crosslinkable and/or polymerizable fluid material comprise at least a molecular sensing moiety which can interact or react with an analyte of interest to provide an optical signal which is indicative of a change in one or more optical properties of the reflection hologram;
irradiating said crosslinkable and/or polymerizable fluid material with at least two beams of coherent light, wherein one of the two beams is directed to the crosslinkable and/or polymerizable fluid material whereas the other beam is directed to the crosslinkable and/or polymerizable fluid material through the second surface, wherein the two beams of coherent light form a pattern of interference fringes while polymerizing/crosslinking said crosslinkable and/or polymerizable fluid material to form the biocompatible sensor, thereby said pattern is recorded in said biocompatible sensor to form a reflection hologram.

33. The method of claim 32, further comprising a step of partially or completely evaporating a solvent in the crosslinkable and/or polymerizable fluid material, or a step of partially

polymerizing and/or crosslinking the crosslinkable and/or polymerizable fluid material, before the step of iiradiating.

34. The method of claim 32 or 33, wherein the crosslinkable and/or polymerizable fluid material comprises a water-soluble prepolymer.

35. A method for making a a biocompatible sensor containing a reflection hologram, comprising the steps of:
providing a mold, wherein the mold has a first mold half defining a first molding surface and a second mold half defining a second molding surface, wherein said first mold half and said second mold half are configured to receive each other such that a cavity is formed between said first molding surface and said second molding surface;
applying a coating of a first crosslinkable and/or polymerizable fluid material onto at least one area on the first molding surface, using a process selected from the group consisting of an air-assisted atomization and dispensing process, an ultrasonic-assisted atomization and dispensing process, a piezoelectric assisted atomization and dispensing process, an electro-mechanical jet printing process, a piezo-electric jet printing process, a piezo-electric with hydrostatic pressure jet printing process, and a thermal jet printing process, wherein the first crosslinkable and/or polymerizable fluid material comprise at least a molecular sensing moiety which can interact or react with an analyte of interest to provide an optical signal which is indicative of a change in one or more optical properties of the reflection hologram;
producing and recording a pattern of interference fringes while polymerizing/crosslinking said first crosslinkable and/or polymerizable fluid material in the coating to form a reflection hologram on the first molding surfaces; introducing a second crosslinkable and/or polymerizable fluid material into the cavity formed by the mold; and
polymerizing/crosslinking the second crosslinkable and/or polymerizable fluid material in the cavity to form the biosensor, wherein the coating having the reflection hologram is transferred from one of the molding surfaces into the biosensor and become an integral part of the biosensor during polymerizing/crosslinking of the second crosslinkable and/or polymerizable fluid material in the cavity.

36. The method of claim 35, wherein the step of producing and recording occurs by irradiating said first crosslinkable and/or polymerizable fluid material with at least two beams of coherent light, wherein one of the two beams is directed directly to the first crosslinkable

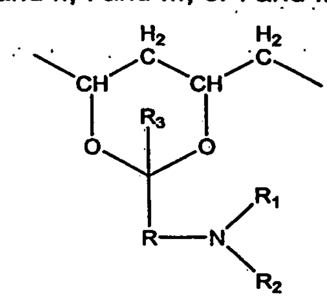
and/or polymerizable fluid material whereas the other beam is directed to the first crosslinkable and/or polymerizable fluid material through at least a portion of the first molding surface, wherein the two beams of coherent light form said pattern while polymerizing/crosslinking said first crosslinkable and/or polymerizable fluid material to form the reflection hologram.

37. The method of claim 35, wherein the second mold half has, on or behind the second molding surface, a mirror to reflect light, wherein the step of producing and recording occurs by directly directing an incident beam of coherent light to said first crosslinkable and/or polymerizable fluid material, wherein the incident beam and a beam reflected by the mirror form said pattern while polymerizing/crosslinking said first crosslinkable and/or polymerizable fluid material to form the reflection hologram.

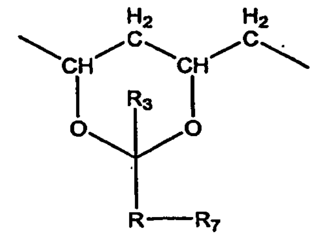
38. The method of claim 35, wherein the first crosslinkable and/or polymerizable fluid material comprises at least one prepolymer and optionally a vinylic monomer, wherein at least one of the prepolymer and the vinylic monomer contains aromatic groups in an amount sufficient to increase refractive index differences (delta n) between areas of different polymer densities which are caused by different irradiations resulted from the pattern of interference fringes.

39. The method of any one of claims 35 to 38, wherein the first crosslinkable and/or polymerizable fluid material comprises a water-soluble prepolymer.

40. The method of claim 39, wherein the water-soluble prepolymer is a polyhydroxyl compound which has a molecular weight of at least about 2000 and comprises from about 0.5 to about 80%, based on the number of hydroxyl groups in the poly(vinyl alcohol), of units of the formula I, I and II, I and III, or I and II and III



I



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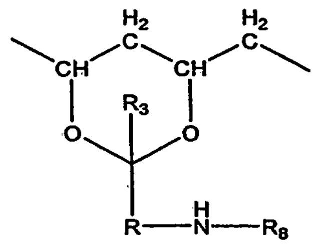


III

wherein R is alkylene having up to 12 carbon atoms; $R_1$ is hydrogen or lower alkyl having up to seven carbon atoms; $R_2$ is an olefinically unsaturated, electron-withdrawing, crosslinkable radical having up to 25 carbon atoms; $R_3$ is hydrogen, a $C_1$ -$C_6$ alkyl group or a cycloalkyl group; $R_7$ is a primary, secondary or tertiary amino group or a quaternary amino group of the formula $N^+(R')_3X^-$, in which each R', independently of the others, is hydrogen or a $C_1$ -$C_4$ alkyl radical and X is a counterion selected from the group consisting of $HSO_4^-$, $F^-$, $Cl^-$, $Br^-$, $I^-$, $CH_3COO^-$, $OH^-$, $BF^-$, and $H_2PO_4^-$; and $R_8$ is the radical of a monobasic, dibasic or tribasic, saturated or unsaturated, aliphatic or aromatic organic acid or sulfonic acid.

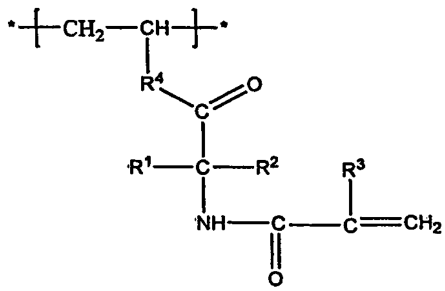
41. The method of claim 40, wherein $R_2$ is an olefinically unsaturated acyl radical of the formula $R_4$ -CO-, in which $R_4$ is an olefinically unsaturated, crosslinkable radical having 2 to 24 carbon atoms.

42. The method of claim 39, wherein the water-soluble prepolymer is a polyurea prepolymer obtained by reacting an acryloylchloride or an isocyanate group-containing acrylate or methacrylate with a polymerization product of $NH_2$-terminated polyalkylene glycols and di- or polyisocyanates optionally in the presence of a triamine.

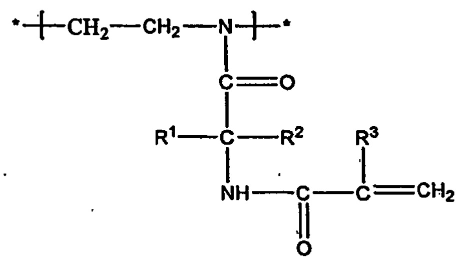
43. The method of claim 39, wherein the water-soluble prepolymer is a vinyl group-terminated polyurethane which is obtained by reacting an isocyanate-capped polyurethane with an ethylenically unsaturated amine (primary or secondary amine) or an ethylenically unsaturated monohydroxy compound, wherein the isocyanate-capped polyurethane is a

copolymerization product of at least one polyalkylene glycol, a compound containing at least 2 hydroxyl groups, and at least one compound with two or more isocyanate groups.

44. The method of claim 39, wherein the water-soluble prepolymer is a derivative of a polyvinyl alcohol, polyethyleneimine or polyvinylamine, wherein the derivative contains from about 0.5 to about 80%, based on the number of hydroxyl groups in the polyvinyl alcohol or the number of imine or amine groups in the polyethyleneimine or polyvinylamine, respectively, of units of the formula VI and VII



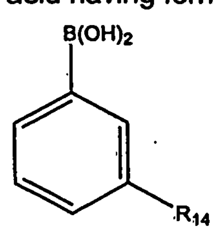
(VI)



(VII)

wherein $R^1$ and $R^2$ are, independently of one another, hydrogen, a $C_1$-$C_8$ alkyl group, an aryl group, or a cyclohexyl group; $R^3$ is hydrogen or a $C_1$-$C_8$ alkyl group; and $R^4$ is an -O- or -NH- bridge, wherein the polyvinyl alcohol, polyethyleneimine or polyvinylamine has a number average molecular weight between about 2000 and 1,000,000.

45. The method of any one of claims 35 to 44, wherein the molecular sensing moiety is a phenyl boronic acid having formula (4), (5), or (6)



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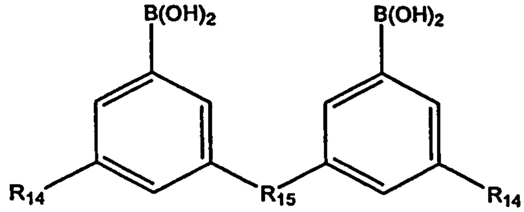


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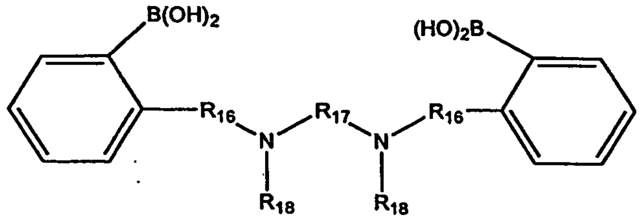



(6)

wherein $R_{14}$ and $R_{18}$, independently of each other, are olefinically unsaturated, crosslinkable radicals; $R_{15}$ and $R_{16}$, independently of each other, are alkylene having up to 12 carbon atoms; and $R_{17}$ is an arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, aryleneaIkylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms.

46. The method of any one of claims 35 to 44, wherein the crosslinkable and/or polymerizable fluid material is an aqueous solution, wherein the aqueous solution includes a low molecular weight additive which exhibit a limited compatibility with a polymer matrix resulted from the crosslinkable and/or polymerizable fluid material, but good compatibility with water, wherein the low molecular weight additive is present in an amount sufficient to increase refractive index differences (delta n) between high and low irradiated areas resulted from the pattern of interference fringes.

47. The method of claim 46, wherein the low molecular weight additive is NaCl.

48. A biocompatible sensor produced according to the method of any one of claims 34 to 47.

49. The biocompatible sensor of claim 48, wherein the biocompatible sensor is an ophthalmic device, especially an implantable ophthalmic device, and in particular an implantable subconjunctival device.

50. A fluid composition for making a biocompatible sensor with a reflection hologram therein, comprising: at least one prepolymer, optionally a vinylic monomer, and a molecular sensing moiety associated with the prepolymer or vinylic monomer, wherein the molecular sensing moiety can interact or react with an analyte of interest to provide an optical signal which is indicative of a change in one or more optical properties of the reflection hologram.

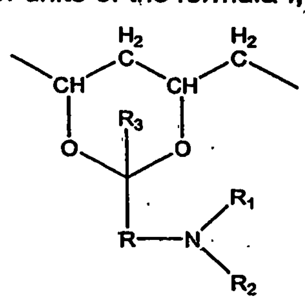
51. The fluid composition of claim 50, wherein the prepolymer is a water-soluble.

52. The fluid composition of claim 50 or 51, wherein the composition comprises water and a low molecular weight additive which exhibit a limited compatibility with a polymer matrix resulted from the crosslinkable and/or polymerizable fluid material, but good compatibility with water, wherein the low molecular weight additive is present in an amount sufficient to increase refractive index differences (delta n) between high and low irradiated areas resulted from the pattern of interference fringes.

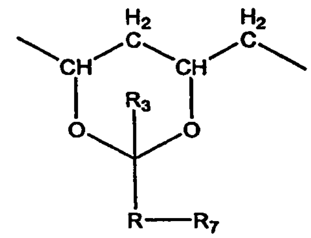
53. The fluid composition of claim 52, wherein the low molecular weight additive is NaCl.

54. The fluid composition of claim 50, wherein the composition comprises aromatic groups associated with the prepolymer and/or the vinylic monomer, wherein the aromatic groups are present in an amount sufficient to increase refractive index differences (delta n) between areas of different polymer densities which are caused by different irradiations resulted from a pattern of interference fringes formed between two beams of coherent light.

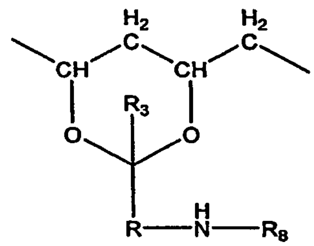
55. The fluid composition of any one of claims 50 to 54, wherein the water-soluble prepolymer is a polyhydroxyl compound which has a molecular weight of at least about 2000 and comprises from about 0.5 to about 80%, based on the number of hydroxyl groups in the poly(vinyl alcohol), of units of the formula I, I and II, I and III, or I and II and III




I



II



III

wherein R is alkylene having up to 12 carbon atoms; $R_1$ is hydrogen or lower alkyl having up to seven carbon atoms; $R_2$ is an olefinically unsaturated, electron-withdrawing, crosslinkable radical having up to 25 carbon atoms; $R_3$ is hydrogen, a $C_1$ -$C_6$ alkyl group or a cycloalkyl group; $R_7$ is a primary, secondary or tertiary amino group or a quaternary amino group of the formula $N^+(R')_3X^-$, in which each R', independently of the others, is hydrogen or a $C_1$ -$C_4$ alkyl radical and X is a counterion selected from the group consisting of $HSO_4^-$, $F^-$, $Cl^-$, $Br^-$, $I^-$, $CH_3COO^-$, $OH^-$, $BF^-$, and $H_2PO_4^-$; and $R_8$ is the radical of a monobasic, dibasic or tribasic, saturated or unsaturated, aliphatic or aromatic organic acid or sulfonic acid.

56. The fluid composition of claim 55, wherein $R_2$ is an olefinically unsaturated acyl radical of the formula $R_4$ -CO-, in which $R_4$ is an olefinically unsaturated, crosslinkable radical having 2 to 24 carbon atoms.

57. The fluid composition of claim 55 or 56, wherein $R_2$ is a radical of formula IV or V

$$\text{-CO-NH-}(R_5\text{-NH-CO-O})_q\text{-}R_6\text{-O-CO-}R_4 \qquad (IV)$$

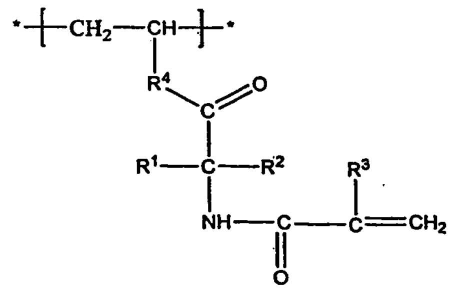
$$\text{-[CO-NH-}(R_5\text{-NH-CO-O})_q\text{-}R_6\text{-O]}_p\text{-CO-}R_4 \qquad (V)$$

wherein p and q, independently of one another, are zero or one; $R_5$ and $R_6$, independently of one another, are lower alkylene having 2 to 8 carbon atoms, arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, arylenealkylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms; and $R_4$ is an olefinically unsaturated, crosslinkable radical having 2 to 24 carbon atoms.

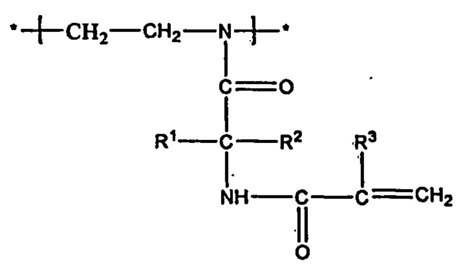
58. The fluid composition of any one of claims 50 to 54, wherein the water-soluble prepolymer is a polyurea prepolymer obtained by reacting an acryloylchloride or an isocyanate group-containing acrylate or methacrylate with a polymerization product of $NH_2$-terminated polyalkylene glycols and di- or polyisocyanates optionally in the presence of a triamine.

59. The fluid composition of any one of claims 50 to 54, wherein the water-soluble prepolymer is a vinyl group-terminated polyurethane which is obtained by reacting an isocyanate-capped polyurethane with an ethylenically unsaturated amine (primary or secondary amine) or an ethylenically unsaturated monohydroxy compound, wherein the isocyanate-capped polyurethane is a copolymerization product of at least one polyalkylene glycol, a compound containing at least 2 hydroxyl groups, and at least one compound with two or more isocyanate groups.

60. The fluid composition of any one of claims 50 to 54, wherein the water-soluble prepolymer is a derivative of a polyvinyl alcohol, polyethyleneimine or polyvinylamine, wherein the derivative contains from about 0.5 to about 80%, based on the number of hydroxyl groups in the polyvinyl alcohol or the number of imine or amine groups in the polyethyleneimine or polyvinylamine, respectively, of units of the formula VI and VII



(VI)

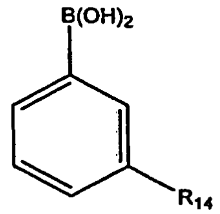


(VII)

wherein $R^1$ and $R^2$ are, independently of one another, hydrogen, a $C_1$-$C_8$ alkyl group, an aryl group, or a cyclohexyl group; $R^3$ is hydrogen or a $C_1$-$C_8$ alkyl group; and $R^4$ is an -O- or -NH-

bridge, wherein the polyvinyl alcohol, polyethyleneimine or polyvinylamine has a number average molecular weight between about 2000 and 1,000,000.

61. The fluid composition of any one of claims 50 to 54, wherein the molecular sensing moiety is a phenyl boronic acid having formula (4), (5), or (6)

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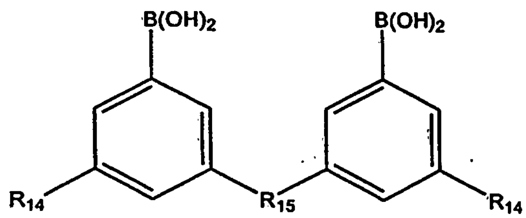


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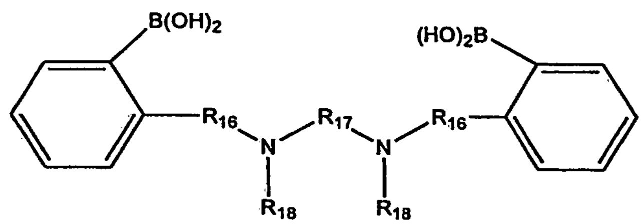


(6)

wherein $R_{14}$ and $R_{18}$, independently of each other, are olefinically unsaturated, crosslinkable radicals; $R_{15}$ and $R_{16}$, independently of each other, are alkylene having up to 12 carbon atoms; and $R_{17}$ is an arylene having 6 to 12 carbon atoms, a saturated bivalent cycloaliphatic group having 6 to 10 carbon atoms, aryleneaikylene or alkylenearylene having 7 to 14 carbon atoms or arylenealkylenearylene having 13 to 16 carbon atoms.

62. Use of an ophthalmic device comprising a hologram-based sensor for monitoring an analyte level in ocular fluid.

63. Use of a hologram-based sensor for the manufacture of an ophthalmic device for the detection of an analyte level in ocular fluid.

64. Use according to claim 62 or 63, wherein the ophthalmic device is an implantable ophthalmic device, in particular an implantable subconjunctival device.

65. Use according to any one of claims 62 to 64, wherein the analyte is glucose.

66. Use according to any one of claims 62 to 65, wherein hologram-based sensor is a reflection hologram-based sensor.